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U. S. Department of Agriculture,

BOTANICAL DIVISION,

SECTION OF VEGETABLE PATHOLOGY.—CIRCULAR No. 3.

TREATMENT OF THE DOWNY MILDEW AND BLACK-ROT OF THE GRAPE.

TO THE VINEYARDISTS OF THE COUNTRY:

Last year a circular was sent out by this Department recommending for trial certain remedies for the mildew and rot of the grape.

The results of experiments in 1886 have fully demonstrated the value of sulphate of copper, "blue stone," over all other remedies in combating the mildew, and the results of many chemical analyses of the fruit and parts of vines treated with the copper compounds have clearly shown that there is no danger to health attending their application. The only precaution advised is not to apply them near (within fifteen days of) the vintage.

In their employment the fact must be kept in mind that their action is only preventive, therefore their application should be made early in the season, from the latter part of May to the end of June. ~~Subsequent applications act only in so far as they serve to check the spread of the disease.~~ The amount of the fluid compounds required to treat an acre of vines will depend largely upon the kind of pump and spraying nozzle used to apply them, and upon the extent of growth of the vines themselves; the amount may vary from 20 to 35 gallons.

The following are the formulæ of the remedies which so far have given the best results. An account of the results of trials you may make with one or more of them is earnestly desired, and a blank form for making up a report for the use of the Department in future publications will be sent you upon the receipt of the addressed postal card inclosed herewith.

LIQUID REMEDIES.

(1) *Simple solution of Sulphate of Copper*.—Dissolve one pound of pure sulphate of copper in 25 gallons of water. Spray the vines with a convenient force-pump having a nozzle of fine aperture. Less lasting in its effect than the next, as it is easily washed off by rains.

(2) *Eau Céleste, Blue water* (the "Audouinaud process").—Dissolve one pound of sulphate of copper in 3 or 4 gallons of warm water; when completely dissolved and the water has cooled, add one pint of commercial ammonia; then dilute to 22 gallons. The concentrated liquid should be kept in a keg or some wooden vessel and diluted when required for use. Apply the same as in the case of simple solutions.

The effects obtained by this preparation have been equal to those resulting from the use of the Copper Mixture of Gironde, and are said to be even more lasting.

(3) *Copper Mixture of Gironde, Bordeaux Mixture*.—Dissolve 16 pounds of sulphate of copper in 22 gallons of water; in another vessel slake 30 pounds of lime in 6 gallons of water. When the latter mixture has cooled, it is slowly poured into the copper solution, care being taken to mix the fluids thoroughly by constant stirring. It is well to have this compound prepared some days before it is required for use.

It should be well stirred before applying. Some have reduced the ingredients to 2 pounds of sulphate of copper and 2 pounds of lime to 22 gallons of water, and have obtained good results.

Well-made pumps with specially constructed nozzles are required for the application of this compound, unless we resort to the tedious and wasteful method of using brooms or whisks made of slender twigs, which are dipped into the compound and then switched right and left so as to spray the foliage, as directed in our circular of last season. The Vermorel apparatus, including reservoir, pump, and spraying nozzle, is well adapted for vineyard use, and is specially constructed for applying the various liquid preparations containing sulphate of copper.

POWDERS.

(4) *David's Powder*.—Dissolve 4 pounds of sulphate of copper in the least possible amount of hot water, and slake 16 pounds of lime with the smallest quantity of water required. When the copper solution and the slaked lime are completely cooled, mix them together thoroughly, let the compound dry in the sun, crush and sift. Apply with a sulphuring bellows furnished with an outside receptacle for the powder. The copper coming in contact with the leather will soon destroy it.

(5) *Sulphatine*.—Mix $2\frac{1}{2}$ pounds of anhydrous sulphate of copper with 15 pounds of triturated sulphur and 10 pounds of air-slaked lime. Apply in the same manner as No. 4.

Both these powders (Nos. 4 and 5) ought to be procured from the manufacturer, prepared ready for use.

NOTE.—It is very probable that Nos. 2, 3, 4, and 5 will be found equally serviceable in preventing potato "blight" and "rot." No. 5 should be employed when one has to contend with both the Downy and Powdery Mildews. For apple scab we suggest trials with Nos. 2 and 3.

The degree of success attending the use of these compounds will depend more or less, (1) upon their careful preparation, (2) the time of the application, (3) the more or less intelligent manner in which they are applied, (4) the atmospheric conditions existing at the time or which may follow the applications, (5) the number of treatments made, and (6) the purity of the copper used.

In all cases where these remedies are tried a number of plants or vines should be left untreated to serve as "control experiments," for comparison with those treated.

Prices of materials (subject, of course, to variations):

Sulphate of copper, pure, in quantity by the barrel	5@6	cents	per	pound.
At retail	10	"	"	"
Anhydrous sulphate of copper	28	"	"	"
Flowers of sulphur, wholesale	$2\frac{1}{2}$	"	"	"
Retail	5@6	"	"	"
Ammonia, wholesale	5@6	"	"	"
Retail	10	"	"	"
Lime, per barrel (200 pounds)	\$1. 05			
"Sulphatine," in quantity	5@6	"	"	"

NORMAN J. COLMAN,
Commissioner of Agriculture.

Washington, D. C., April 1887.